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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample is also included. (AG)

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ED 062412

FINAL REPORT

TECHNICAL REPORT

ON

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

FOR

GOGGLE GLASS CUTTER-(Lens Cutter)
(optical goods) ~~7~~-09.026

B-412

ED 001 300

U. S. Employment Service in
Cooperation with
Pennsylvania State Employment Service

U. S. DEPARTMENT OF LABOR
Bureau of Employment Security
Washington 25, D. C.
January 1959

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GATB #2221
September, 1957

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY
FOR
GOGGLE-GLASS CUTTER (Lens Cutter) 713.884

S-148

Summary

The General Aptitude Test Battery, B-1002A, was administered in September, 1957 to 50 female workers employed as Goggle-Glass Cutters (Lens Cutter) 713.884 at the House Glass Corporation in Point Marion, Pennsylvania. The criterion consisted of the foreman's rank order ratings converted to linear scores. On the basis of mean scores, standard deviations, correlations with the criterion, job analysis data, and their combined selective efficiency, Aptitudes K-Motor Coordination and F-Finger Dexterity were selected for inclusion in the test norms.

GATB Norms for Goggle-Glass Cutter (Lens Cutter) 713.884 - S-148

Table I shows, for B-1001 and B-1002, the minimum acceptable score for each aptitude included in the test norms for Goggle-Glass Cutter (Lens Cutter) 713.884.

TABLE I

Minimum Acceptable Scores on B-1001 and B-1002 for S-148

B-1001			B-1002		
Aptitude	Tests	Minimum Acceptable Aptitude Score	Aptitude	Tests	Minimum Acceptable Aptitude Score
T	CB-1-G CB-1-K	85	K	Part 8	90
F	CB-1-O CB-1-P	90	F	Part 11 Part 12	85

Effectiveness of Norms

The data in Table IV indicate that 10 of the 16 poor workers, or 63 percent of them, did not achieve the minimum scores established as cutting scores on the recommended test norms. This shows that 63 percent of the poor workers would not have been hired if the recommended test norms had been used in the selection process. Moreover, 26 of the 32 workers who made qualifying test scores, or 81 percent, were good workers.

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I. Problem

This study was conducted to determine the best combination of aptitudes and minimum scores to be used as norms on the General Aptitude Test Battery for the occupation of Goggle-Glass Cutter (Lens Cutter) 713.884.

II. Sample

The General Aptitude Test Battery, B-1002A, was administered in September, 1957, to 55 women employed as Goggle-Glass Cutters (Lens Cutter) 713.884 at the Houze Glass Corporation plant in Point Marion, Pennsylvania. Five persons were later eliminated from the sample because of their age leaving a final experimental sample of 50 workers.

New workers receive on-the-job training from the foreman. The company estimates that new workers take a maximum of six months to reach the required production standards. All workers in the sample had at least six months of experience when they were rated.

There are no experience requirements for this job, and the company considers a grade school education sufficient for performing the job. However, each worker must be able to read job orders and write up her own work tickets.

Table II shows the means, standard deviations, ranges, and Pearson product-moment correlations with the criterion for age, education, and experience.

TABLE II

Means (M), Standard Deviations (σ), Ranges, and Pearson Product-Moment Correlations with the Criterion (r) for Age, Education, and Experience

Goggle-Glass Cutter (Lens Cutter) 713.884
N = 50

	M	σ	Range	r
Age (years)	36.0	5.6	24-48	-.229
Education (years)	9.9	1.8	6-13	.061
Experience (months)	139.1	62.4	12-336	.050

There are no significant correlations between age, education, or experience and the criterion. The data in Table II indicate that the sample is suitable for test development purposes with respect to age, education, and experience.

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III. Job Description

Job Title: Goggle-Glass Cutter (Lens Cutter) 78.684

Job Summary: Cuts lenses for sunglasses and welding goggles, from flat sheets of glass, using a glass-cutting machine and hand glass-cutting tool. Examines each sheet visually for such defects as seeds, bubbles, scratches, or wavy lines, marking each defect by circling it with a white marking crayon. Scribes the lens shape on the glass sheet with the cutting machine, being careful to avoid cutting into any areas where defects have been marked and still achieve maximum output. Quickly draws straight lines across glass sheet between scribed lens shapes to cut the glass.

Work Performed: Obtains a supply of flat glass sheets from stock table and carries them to work station.

Examines each sheet visually, looking for such defects as seeds, bubbles, scratches or wavy lines, whose presence in the finished lens would cause them to be rejected. Marks each defect noted by circling it with a white marking crayon. Places examined sheet on a stack. Completes inspection of each sheet in stock pile.

Picks up the top sheet of examined glass and places it on bed of glass-cutting machine, supporting the glass with the left hand while positioning it under the cutting wheel. Grasps the knob of the turning handle at the top of the glass-cutting machine with the right hand. Turns the handle clockwise in a 360° horizontal plane while exerting a downward pressure on the handle to bring the cutting wheel to bear against the glass to scribe the lens shape on the glass sheet. Moves sheet of glass on bed of cutting machine approximately one-and-one-quarter the diameter of the lens, and to the right of the last scribed lens, to cut the next lens. Continues to scribe lens shapes on the sheet of glass, being careful to avoid cutting into any areas where defects have been marked and still achieve maximum output.

Lays scribed sheet of glass on surface of work table. Picks up hand glass-cutter and dips the point (cutting wheel) of the tool into a small container of kerosene to lubricate the wheel for free running over surface of glass sheet. Quickly draws straight lines across glass sheet between scribed lens shapes to cut the glass. Breaks lenses away from glass sheet by lifting up on edge of sheet nearest to worker with right hand, at the same time pressing down on glass sheet with left hand at point where glass was cut with the hand cutter. Picks up lenses, visually examining each one for scratches and rough edges or possible defects missed in the first examination, and places perfect lenses on edge in a wooden tray. Prepares a work ticket for each filled tray. Sweeps waste glass with gloved left hand into tray held on lap. Empties this tray, when filled, into waste can placed beside worker. Tests a random sample of lenses for size by placing them in a master template to insure that the glass-cutting machine is scribing proper size lens shapes. Adjusts cutter wheel of glass-cutting machine if it is scribing plus or minus tolerances for the particular lens being cut.

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Removes dull cutting wheels from a lens-cutting machine, using a screw-driver to snap the U-shaped wheel-holder out of the machine. Places a sharpened cutting wheel in the wheel-holder and snaps it into the machine with finger pressure.

IV. Experimental Battery

All the tests of the GATB, B-1002A, were administered to the sample.

V. Criterion

The criterion for this study consists of rank order ratings converted to linear scores. The workers in the sample group were listed in rank order by the department foreman, who was the only person in a position to rate the sample. He indicated that a second rating would not change the order in which the workers were rated initially, so the initial ratings were used in the conversion to linear scores. The linear scores ranged from 7 to 93, with a mean of 50.020 and a standard deviation of 19.063.

The foreman stated that he considered sixteen of the workers to be poor workers (32% of the sample), so these were designated as the low criterion group. The remaining 34 workers (68% of the sample) constituted the high criterion group.

VI. Statistical and Qualitative Analysis

A. Statistical Analysis:

Table III shows the means, standard deviations, and Pearson product-moment correlations with the criterion for the aptitudes of the GATB. The means and standard deviations of the aptitudes are comparable to general working population norms with a mean of 100 and a standard deviation of 20.

TABLE III

Means (M), Standard Deviations (σ), and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB

Goggle-Glass Cutter (Lens Cutter) 713.884
N = 50

Aptitudes	M	σ	r
G-Intelligence	90.7	11.5	-.181
V-Verbal Aptitude	92.9	11.1	-.079
N-Numerical Aptitude	91.4	14.4	.066
S-Spatial Aptitude	91.3	14.1	-.112
P-Form Perception	96.4	18.6	.100
Q-Clerical Perception	98.2	14.6	.154
K-Motor Coordination	100.8#	15.7	.283*
F-Finger Dexterity	100.0#	17.8	.274
M-Manual Dexterity	105.5#	20.8	-.001

* Significant at the .01 level
\# Relatively High Mean Score

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The highest mean scores in descending order of magnitude were obtained for Aptitudes M, K, and F respectively. All the aptitudes, except Aptitudes P, have standard deviations of less than 20. Aptitude V has the lowest standard deviation. For a sample of 50 cases, correlations of .361 and .279 are significant at the .01 level and the .05 level of confidence, respectively. Aptitude K correlates significantly with the criterion at the .05 level.

B. Qualitative Analysis:

The statistical results were interpreted in the light of the job analysis data. The job analysis indicated that the following aptitudes measured by the GATB appear to be important for this occupation.

Form Perception (P) - required to examine glass sheets for the presence of defects, and to examine lens blanks for defects such as scratches, rough edges, and over or undersize.

Motor Coordination (K) - required to position glass sheet under cutting wheel on bed of glass-cutting machine, and to scribe lens shapes.

Finger Dexterity (F) - required to accurately cut lens blanks out of glass sheet with hand glass-cutting tool, to pick up lenses for examination, and to rack them in wood tray.

Manual Dexterity (M) - required to position glass sheets for first examination, and to position the sheets for machine scribing and hand cutting.

C. Selection of Test Norms:

Based on the quantitative and qualitative evidence cited above, Aptitudes K, F, and M warranted further consideration for inclusion in the test norms. The evidence for each of these aptitudes is indicated below.

Aptitude	Relatively High Mean Score	Significant Correlation with the Criterion	Importance Indicated by Qualitative Analysis
K	X	X	X
F	X		X
M	X		X

Although Aptitude P appeared to be important on the basis of the job analysis data, it was not considered further for inclusion in the norms because there was no quantitative evidence of significance.

Various combinations of these aptitudes with appropriate cutting scores were selected as trial norms. The relationship between each set of trial norms and the criterion (dichotomized as indicated in section V) was determined.

A comparison of the results showed that norms consisting of K-90 and F-85 for B-1002 and equivalent norms of T-85 and F-90 for B-1001 had the best selective efficiency.

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In test development studies an attempt is made to develop a set of norms such that the cutting score for each aptitude included in the norms will be set at a five-point score level close to one standard deviation below the aptitude mean of the experimental sample. Adjustments of cutting scores from one standard deviation below the mean are made to effect better selective efficiency of the norms. In this study the aptitude cutting scores are each within five points of one standard deviation below the aptitude mean of the sample.

VII. For the purpose of computing the tetrachoric correlation coefficient between the test norms and the criterion and applying the Chi Square test, the criterion was dichotomized as indicated in Section V. Sixteen of the 50 workers, or 32 percent of the sample were placed in the low criterion group.

Table IV shows the relationship between test norms consisting of Aptitudes K and F with critical scores of 90 and 85 respectively, and the dichotomized criterion for Goggle-Glass Cutter (Lens Cutter) 713.884 . Workers in the high criterion group have been designated as "good workers" and those in the low criterion group as "poor workers."

TABLE IV

Relationship between Test Norms Consisting of Aptitudes K and F with Critical Scores of 90 and 85 Respectively, and the Criterion for Goggle-Glass Cutter (Lens Cutter) 713.884

N = 50

	Non-Qualifying Test Scores	Qualifying Test Scores	Total
Good Workers	8	26	34
Poor Workers	10	6	16
Total	18	32	50

$r_{tet} = .59$ $\quad X^2 = 5.580$

$\sigma_{r_{tet}} = .23$ $\quad P/2 < .01$

The data in the above table indicate a significant relationship between the test norms and the criterion for the sample.

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VIII. Conclusions

On the basis of mean scores, correlations with the criterion, job analysis data, and their combined selective efficiency, Aptitudes K and F with minimum scores of 90 and 85 respectively, are recommended as B-1002 norms for the occupation of Goggle-Glass Cutter (Lens Cutter) 713.684 . The equivalent B-1001 norms consist of T-85 and F-90.

IX. Determination of Occupational Aptitude Pattern

When the specific test norms for an occupation include two aptitudes, only those occupational aptitude patterns which include those two aptitudes with cutting scores that are within 10 points of the cutting scores established for the specific norms are considered for that occupation. The only one of the existing 23 occupational aptitude patterns which meets these criteria for this study is OAP-17, which consists of K-85, F-80, and M-80 for B-1002. The selective efficiency of OAP-17 for this sample was determined by means of the tetrachoric correlation technique. The tetrachoric correlation between OAP-17 and the dichotomized criterion for this sample did not indicate a significant relationship. Therefore, none of the existing occupational aptitude patterns is recommended for the occupation covered by this study. However, the data for this sample will be considered for future groupings of occupations in the development of new occupational aptitude patterns.